A SURVEY OF TUBERCULOSIS IN AN INDUSTRIAL COUNTY OF SCOTLAND : THE INFLUENCE OF SOCIAL FACTORS ON THE INCIDENCE OF TUBERCULOUS INFECTIONS.

At the British Congress on Tuberculosis held in London in 1901, Koch announced that human tuberculosis was distinct from bovine tuberculosis and could not be transmitted to cattle. He went further and, on the analogy of his experimental failure to infect calves and swine with progressive tuberculosis by inoculation with the human bacillus, he assumed as a corollary that the bovine tubercle bacillus must be harmless for man.

This assertion was contested and investigations were instituted in this country and abroad to inquire into the relations of human and animal tuberculosis. In 1911 a Royal Commission in England reported the results of official investigations; extensive corroboration of the findings from other home and foreign workers proved conclusively that Koch was wrong in his opinion that the bovine tubercle bacillus was a negligible factor in human tuberculosis.

Interest in Scotland has been centred mainly in

the incidence in human tuberculosis of the different types of tubercle bacillus. Fraser (1912) examined 67 cases of bone and joint tuberculosis in children and found that 61.2% were infected with bovine bacilli. Wang (1917) reported 55% of bovine infections in 20 children under sixteen years of age and 10.3% in 68 adults in the Edinburgh district. Munro and Cumming (1926) found bovine bacilli in 36.4% of 55 cases of surgical tuberculosis in the East of Scotland. Blacklock (1936) isolated the bovine bacillus from 82.2% of 73 children with primary abdominal tuberculosis and from 63.3% of 30 patients with cervical gland tuberculosis. He noted a higher incidence of bovine bacilli in country than in Glasgow children. Blacklock and Griffen (1935) found that 22% of cases of cerebral tuberculosis in children in the same West of Scotland area were due to the bovine bacillus.

The importance of factors other than the type of organism had become manifest for it was obvious that the proportional frequency of the type of infecting organism varied greatly in different districts.

Griffith (1934), in surveying the results of typing 265 strains of tubercle bacilli isolated from cases of tuberculous meningitis occurring between

1905 and 1933 and derived from widely separated areas throughout the United Kingdom, noted that the incidence of bovine infection was higher, in general, in country places and rural towns than it was in cities. Munro and Scott (1936) reviewed the relative frequency of human and bovine bacilli recovered from cerebro-spinal fluids in patients from the East of Scotland and concluded that bovine infection was an urgent rural problem as, in the series examined, the incidence of this type was three times greater in rural areas than it was in cities. This conclusion was supported by the work of Macgregor and Green (1937) who found 2% of bovine infections in 68 cases of tuberculous meningitis occurring in the City of Edinburgh and 25% in 29 cases from the adjoining country districts.

The importance of raw milk was stressed by these workers as a possible reason for the rural preponderance of the bovine type of tubercle bacillus, however, in an investigation of 91 patients suffering from pulmonary tuberculosis and residing in the rural areas and small towns in the North East of Scotland, Griffith and Smith (1935) found 14.3% with bovine tubercle bacilli in the sputum. The possibility of infection of susceptibles with the bovine organism

by such persons is a factor that cannot be overlooked.

Wright and Wright (1942) discussed the influence of social conditions on illness in childhood in London Boroughs. They analysed statistical data of the morbidity and mortality of diphtheria, measles, whooping cough and tuberculosis for the period 1924 - 1938 and, by comparing with data for social conditions in the same area, they determined the correlation between illness and social factors. The effects of substandard housing and of the deprivation of many of the amenities of life - food, heat and clothing - through deficient economic resources were noted as important factors in the distribution of tuberculosis among young children; the authors concluded that it would be unwise to infer how poverty operates in addition to the increased physical proximity of overcrowding.

Tuberculosis in Lanarkshire.

Since 1937 I have isolated and typed strains of the tubercle bacillus from specimens derived from patients residing in the County of Lanark. At the same time I have ascertained, as far as possible, sufficient data to enable me to scrutinise other

factors that may be of interest and to explore the virgin field of tuberculous Lanarkshire.

Lanarkshire is a large county with a peculiar character for, although it is the most highly industrialised county in Scotland, a fact given by Barclay and Kermack (1940) in an examination of the effects of industrialisation on the mortality from cancer, the industrial area occupies only about a quarter of the total acreage and there is almost a sharp line of demarcation from the rural areas.

The estimated population in 1939 according to figures supplied by the Registrar General and given to me by the Medical Officers of Health for the several administrative areas within the scope of this investigation was 506,196 persons and the total area 536,075 acres.

Table I gives the administrative distribution of the population.

Of the total population 443,772 persons resided within the purview of the industrial area of 135,187 acres and 62,424 persons occupied the rural districts that extend to 400,888 acres. From this it will be seen that the incidence of disease in industrial and rural areas may be compared.

In the Annual Report of the Sanitary Inspector

TABLE I

Administrative Distribution of Population.

	Population	Acreage
County of Lanark (Landward)	296,012	521,642
Burgh of Biggar	1,312	67
Burgh of Lanark	6,046	507
Burgh of Motherwell and Wishaw	64,748	4,714
Burgh of Coatbridge	45,170	3,081
Burgh of Hamilton	39,194	2,950
Burgh of Airdrie	28,295	2,068
Burgh of Rutherglen	25,419	1,046
	506,196	536,075

for the Landward area of the County of Lanark (1939) attention was drawn to the general position of overcrowding and, while a slight improvement was noted in rural areas, the situation in the industrial area was considered "deplorable". Despite attempts to alleviate conditions there still remained on the register at the end of 1939, 18,756 overcrowded dwelling houses, containing 22,554 families with a total of 96,969 persons. This showed that 32.1% of

the entire Landward community lived under conditions of overcrowding. Primitive sanitation has aggravated the burden of lack of accommodation in many districts.

The figures in this investigation include evidence collected from 1937 until the end of 1942 and, while they do not represent all the notified cases of non-pulmonary tuberculosis, they do represent most of the patients from whom viable tubercle bacilli were recovered during this period. The pulmonary figures are a random selection.

Bacteriological Methods.

Specimens of cerebro-spinal fluid were inspected for the presence of coagulum and centrifugalised at 3,000 r.p.m. for half-an-hour. Films of the deposit were made, stained by Ziehl-Neelsen's method and examined microscopically for the presence of tubercle bacilli. All specimens were inoculated into guinea-pigs.

If sufficient fluid was submitted, direct seeding from the deposit on to selective media was carried out but, in the presence of contamination as determined by microscopic examination, or in the event of the specimen being of smaller volume than 5 c.c.,

guinea-pigs were inoculated in the left groin with the entire deposit to which had been added a few c.c. of the supernatant fluid.

Inoculated animals were examined every three days and killed when enlargement of inguinal glands had progressed sufficiently, usually about five to six weeks after inoculation. At necropsy the extent of macroscopic tuberculosis was noted and microscopic examination of material from a lesion was examined for confirmation.

The inguinal gland was removed with aseptic precautions and the pus digested with 6% HCl. After half-an-hour's acid treatment neutralisation by NaOH was carried out and the resulting suspension of debris centrifugalised for half-an-hour at 3,000 r.p.m. The deposit was seeded on to (1) Herrold's medium, (2) Löwenstein-Jensen medium (3) Löwenstein-Jensen Glycerol medium. After incubation for a week, cultures were examined every three days for the appearance of growth. When colonies had been visible for about three weeks the strain was used for rabbit inoculation.

Rabbit Inoculation. A suspension of tubercle bacilli containing approximately 0.1 milligrams moist weight of culture was injected into the marginal ear vein of

a fully grown adult rabbit. Animals were kept in separate cages and killed after two months if they had shown no evidence of advanced disease before this time. At post-mortem examination the macroscopic lesions and their distributions were noted and confirmatory microscopic examination of films from the lesions carried out. The type of organism was thus established.

Pus and tissue was examined microscopically for the presence of tubercle bacilli. Specimens were then treated with 6% HCl. for half-an-hour, the acid neutralised by NaOH and the deposited debris, after centrifugalisation, investigated by guinea-pig inoculation and direct cultural methods.

The final type differentiation of strains of tubercle bacilli isolated was determined by rabbit inoculation.

Results.

Pathological specimens from 464 patients suffering from extrapulmonary tuberculosis or suspected of having tuberculous lesions were examined for the tubercle bacillus.

From 321 persons strains of tubercle bacilli were

isolated and an attempt made at type determination. This was successful in 311 instances and type was not established in ten cases. In a further nine specimens, five from cervical glands and four from bone and joint lesions, acid-alcohol-fast bacilli were demonstrated on direct film examination but isolation on selective media was not successful and the organism did not give rise to tuberculosis on inoculation into guinea-pigs.

Strains recovered by cultural methods from the sputum of eighty persons suffering from pulmonary tuberculosis were also typed, the final criterion being taken as virulence for the rabbit.

General Incidence of Human and Bovine Types of Tubercle Bacillus.

Of the 80 pulmonary strains investigated 78 were human and 2 bovine giving percentages of 97.5 and 2.5 respectively.

The extrapulmonary strains gave the proportions of human tubercle bacilli as 73.3% (228 strains) and of bovine tubercle bacilli as 26.7% (83 strains) and were derived from the following sources.

Samples of cerebro-spinal fluid from 165 patients with tuberculous meningitis supplied 118 human strains

(71.5%) and 47 bovine strains (28.5%).

The tubercle bacillus isolated from 72 cases of cervical adenitis was human in type in 50 instances (69.6%) and bovine in 22 (30.4%).

Material obtained from 74 persons with bone and joint infection provided 60 (81.1%) tubercle bacilli of the human type and 14 (18.9%) strains of the bovine type.

Table II gives the occurrence of the two types of tubercle bacillus in the different varieties of tuberculosis examined in this investigation.

TABLE II

General Incidence of Human and Bovine Strains of the Tubercle Bacillus.

	Pulmonary Tuberculosis	Tuberculous Meningitis	Cervical Adenitis	Bone and Joint Tuberculosis
Human	78 (97.5%)	118 (71.5%)	50 (69.6%)	60 (81.1%)
Bovine	2 (2.5%)	47 (28.5%)	22 (30.4%)	14 (18.9%)

The type of bacillary infection in relation to age group incidence for all non-pulmonary varieties of disease is shown in Table III.

The first five years of life and the five years from fifteen to twenty years of age showed an almost equal frequency of infection and accounted for nearly

half of the total number of cases.

TABLE III

Age and Sex Incidence for all Extrapulmonary Tuberculosis.

	Age (years)									
	Under 5	-10	-15	-20	-25	-30	-40	-50	-60	Total
Human										
Male	30	22	15	39	5	4	4	3	4	126
Female	22	18	6	25	16	5	3	4	3	102
	52	40	21	64	21	9	7	7	7	228
Bovine										
Male	14	11	7	2	7	1	4	-	-	46
Female	10	9	3	6	8	-	-	1	-	37
	24	20	10	8	15	1	4	1	-	83

Bovine infections were much more numerous in the younger groups and forty-four of the total of eighty-three bovine strains of the organism were recovered from patients in the first decade.

That the greatest risk of bovine infection is in the first few years of life is borne out by these figures.

The sex incidence for all extrapulmonary tuberculous infections is given in Table IV.

Males appeared to be more liable to infection than females. This was mainly due to the greater number of males with bone and joint lesions, a fact to which the more strenuous life of males probably

contributed.

TABLE IV

Sex Incidence of Human and Bovine Infections in Extrapulmonary Tuberculosis.

	Tuberculous Meningitis	Cervical Adenitis	Bone and Joint Tuberculosis	Total
Human				
Male	59	28	39	126
Female	59	22	21	102
Bovine				
Male	24	11	11	46
Female	23	11	3	37

Regional Incidence. An analysis of the regional incidence of infection showed that 18 of 165 cases of tuberculous meningitis, 20 of 72 cases of tuberculous adenitis and 11 of 74 cases of bone and joint tuberculosis occurred in persons residing in the rural areas, a total of 49 of the 311 cases investigated in this series. The distribution of the two types of tubercle bacillus in industrial and rural areas for the extrapulmonary group of infections is considered in the ensuing paragraphs.

Tuberculous Meningitis.

Age Incidence. In the industrial area 40 of a total

of 147 cases (27.9%) of tuberculous meningitis occurred in the first five years of life and 40 cases (27.9%) in the period between fifteen and twenty years of age, in other words, just over half of the total number of cases occurred either in the first few years of life or in the first few years of going out into the employment market. In the rural area 9 cases out of a total of 18 (50%) occurred before five years of age and, although there was a high incidence of infection between the ages of fifteen and twenty-five years of age, 3 cases (16.7%) in each of the five year periods in this group, it was not so high or noticeable as in the industrial series, however, the figures were sufficiently significant to show the greater liability to infection at the age groups already noted.

Type Incidence. The frequency of bovine infection was 26.4% in the industrial area and 44.4% in the rural area, figures that endorse the rural preponderance of the bovine bacillus in tuberculous meningitis found by other workers. (Griffith (1934), Blacklock (1936), Munro and Scott (1936), Macgregor and Green (1937)).

In the 165 cases of tuberculous meningitis investigated bovine infections were more numerous in

the early years of life; 17 of the 47 strains were isolated (36.2%) from children under five years of age and a further 10 (21.3%) from the next five year period showing that 57.5% of bovine infections occurred before ten years of age.

TABLE V

Age and Sex Incidence of Tuberculous Meningitis.

	Age (years)									
	Under 5	-10	-15	-20	-25	-30	-40	-50	-60	Total
INDUSTRIAL										
Human										
Male	15	10	6	20	-	-	-	1	2	54
Female	12	8	4	15	11	1	-	2	1	54
	27	18	10	35	11	1	-	3	3	108
Bovine										
Male	6	6	2	1	3	-	2	-	-	20
Female	7	3	2	4	3	-	-	-	-	19
	13	9	4	5	6	-	2	-	-	39
RURAL										
Human										
Male	2	-	2	1	-	-	-	-	-	5
Female	3	-	1	1	-	-	-	-	-	5
	5	-	3	2	-	-	-	-	-	10
Bovine										
Male	2	-	-	-	1	-	1	-	-	4
Female	2	1	-	1	-	-	-	-	-	4
	4	1	-	1	1	-	1	-	-	8

In the rural areas the percentage of bovine bacilli isolated from persons in the first five years

of life was 50% of the total (4 of 8 strains) and in the industrial area 33.3% (13 of 39 strains).

The relative incidence of the two types of tubercle bacillus in the industrial area was almost constant for the three five-year groups under fifteen years of age; the percentages of bovine infections were 32.5, 33.3 and 28.6 respectively. The early adolescent group from fifteen to twenty years of age, the period of entry into industry, showed a tremendous preponderance of human infections with 35 out of a total of 40 cases (87.5%) but the balance was re-established in the following five year group with 35.3% of bovine infections, 6 cases out of a total of 17. For older persons numbers were too small for analysis.

In the rural area bovine infections accounted for 44.4% of the cases in children under five years of age.

Sex Incidence. In the series, males and females were affected equally as regards frequency of infection and type of infecting tubercle bacillus although there were minor variations at different ages. The only significant variations were the greater number of males with human infection in the early adolescent group and this was countered by a similar preponder-

ance in females in the early twenties.

Tuberculous Cervical Adenitis.

Age Incidence. The age group with the highest frequency of infection in the 72 cases of cervical adenitis investigated was that from five to ten years of age with 24 persons affected (33.3%). Of the total, 50 persons were under fifteen years of age so that 69.4% of infections had taken place during preschool and school age.

In the industrial area 27 out of 34 persons with human infections (76.4%) had not reached the age of twenty at the time specimens were obtained and, in the rural area, 12 out of 16 (75%) subjects from whom the human tubercle bacillus had been isolated were under fifteen years of age.

From this it will be seen that a comparable majority of cases had come under observation five years earlier in rural districts than in industrial districts.

Type Incidence. In the industrial area the relative incidence of type of infecting bacillus was 34.6% bovine and 65.4% human. There were 18 bovine and 34 human strains of tubercle bacillus isolated. In the

TABLE VI

Age and Sex Incidence
of Tuberculous Cervical Adenitis.

	Age (years)									
	Under 5	-10	-15	-20	-25	-30	-40	-50	-60	Total
INDUSTRIAL										
Human										
Male	6	5	2	2	-	-	1	-	1	17
Female	3	5	1	3	1	2	1	1	-	17
	9	10	3	5	1	2	2	1	1	34
Bovine										
Male	2	1	4	-	-	1	1	-	-	9
Female	1	4	1	-	3	-	-	-	-	9
	3	5	5	-	3	1	1	-	-	18
RURAL										
Human										
Male	3	3	3	1	-	1	-	-	-	11
Female	-	3	-	-	1	-	-	-	1	5
	3	6	3	1	1	1	-	-	1	16
Bovine										
Male	-	2	-	-	-	-	-	-	-	2
Female	-	1	-	1	-	-	-	-	-	2
	-	3	-	1	-	-	-	-	-	4

rural area the human type of bacillus predominated with 80% of 20 cases and there were only 20% (4) bovine infections.

The majority of bovine infections had taken place before fifteen years of age for, in the industrial group, 13 of 18 patients (72.2%) had been under treatment before this age had been reached and

3 out of 4 (75%) of the rural cases were under ten years of age.

The relative incidence of human and bovine bacilli in the three quinquennia up to fifteen years of age in the industrial area showed 25%, 50% and 62.5% bovine infections respectively. In the rural area 33.3% of the infections in the five to ten years age group were bovine; there were no bovine infections under five years of age and none from ten to fifteen years of age.

Bovine infections were present five years earlier than human infections in industrial and in rural areas.

Sex Incidence. The frequency of infection and the type of organism were equal for each sex except in human infections in the rural areas where there was an excess of infected males in the proportion of 11 males to 5 females. This was due to three males under five and three males between ten and fourteen years of age having infections and no females of those ages being affected. These six cases influenced the rural incidence of bovine infections (20%) for they accounted for 37.5% of the total of 16 human infections.

Bone and Joint Tuberculosis.

Age Incidence. To assess figures in bone and joint infections is always difficult and of doubtful value

TABLE VII

Age and Sex Incidence
of Bone and Joint Tuberculosis.

	Age (years)									
	Under 5	-10	-15	-20	-25	-30	-40	-50	-60	Total
INDUSTRIAL										
Human										
Male	4	3	1	15	4	3	2	2	1	35
Female	4	2	-	4	2	2	2	1	1	18
	8	5	1	19	6	5	4	3	2	53
Bovine										
Male	3	2	-	1	2	-	-	-	-	8
Female	-	-	-	-	2	-	-	-	-	2
	3	2	-	1	4	-	-	-	-	10
RURAL										
Human										
Male	-	1	1	-	1	-	1	-	-	4
Female	-	-	-	2	1	-	-	-	-	3
	-	1	1	2	2	-	1	-	-	7
Bovine										
Male	1	-	1	-	1	-	-	-	-	3
Female	-	-	-	-	-	-	-	1	-	1
	1	-	1	-	1	-	-	1	-	4

in determining age incidence as patients may have obvious lesions for several years before specimens are available for isolation of the tubercle bacillus, however, there was an apparent highest incidence of

infection in the five years under twenty in the industrial series with 20 cases out of a total of 63 (31.8%); the first five years of life showed the next highest occurrence with 11 persons infected (17.4%).

In the rural area the small number of cases available may vitiate the significance of the occurrence between fifteen and twenty-five years of age of 5 of the total 11 cases (45.5%).

Type Incidence. In the industrial area bovine infections accounted for 10 out of 63 cases (15.9%) and in the rural area for 4 out of 11 cases (36.4%). All bovine cases in the industrial area had come under treatment before reaching twenty-five years of age. The percentages for the first two age groups of five years were 27.3 and 28.6 of bovine infections. In the fifteen to twenty years group only 5%, 1 case out of 20, were due to the bovine bacillus but in the next five years group bovine strains were isolated from 4 out of 10 persons (40%).

Sex Incidence. Males appeared to be more susceptible to bone and joint infection than females - roughly in the proportion of 2 to 1 for the entire series. In bovine infection males provided 80% of the total cases in the industrial and 75% in the

rural area; in human infections males were 66% of the industrial and 57.1% of the rural subjects affected.

Discussion. Lanarkshire is essentially an industrial county and accommodates about an eighth of the total population of Scotland so that the results of these investigations supply an essential link in the already vast chain of Scottish evidence in tuberculosis statistics. The regional variation noted by other workers is supported and the importance of the rural mode of life in infection with the bovine type of tubercle bacillus is again manifest.

The pulmonary cases included in this series were a random selection primarily investigated by cultural methods with the intention of demonstrating tubercle bacilli which microscopic examination had failed to disclose in sputa. In many instances the organism was found on subsequent examination or after digestion of the sputum.

No attempt was made to classify the patients from whom specimens were obtained and the figures are of interest as showing a percentage of bovine infection, 2.5% of 80 cases, approximating more

closely to that of Griffith (1930) who found 1.4% of bovine infections in 73 pulmonary cases in Scotland than to the higher incidence found by Munro (1929), 7.1% of 70 cases in the East of Scotland and by Griffith and Smith (1935), 14.3% of 91 cases from the Northern Counties of Scotland.

Much work has been done on tuberculous meningitis and the regional variation in the type of infecting tubercle bacillus has been marked, for Griffith (1934) in surveying a series of cases collected from 1905 to 1933 gave a bovine incidence for Scotland of 40.5%, Blacklock and Griffen (1935) gave 22% for a series in the West of Scotland, Munro and Scott (1936) found 36% of bovine infections in the East of Scotland and Macgregor and Green (1937) 24% in the Edinburgh district. For Lanarkshire 47 bovine and 118 human strains of tubercle bacilli isolated from 165 cases of tuberculous meningitis gave the bovine percentage of 28.5.

The relative incidence of human and bovine tubercle bacilli isolated from 73 cervical adenitis cases was 30.6% bovine and 69.4% human, figures that do not agree with any previously published for Scotland. Griffith (1930) found 70.6% bovine infections in 17 Scottish cases and Blacklock (1936)

63.3% in 30 children in the West of Scotland area. Möllers (1928) summarised continental statistics and for 219 cases of cervical adenitis he gave the percentage of bovine infections as 24.2 so that the figures for this investigation are between those of foreign workers and those found in the less industrialised parts of Scotland.

In bone and joint tuberculosis bovine infections provided 18.9% of the 74 strains of tubercle bacilli isolated. This figure approximates to the 20.5% of bovine infections among 88 cases examined by Wang (1917) in Edinburgh but is much lower than the bovine incidence found by Fraser (1912) of 61.3% or the 36.4% given by Munro and Cumming (1926).

Early in this investigation it became obvious that there was a higher incidence of human infections than had been found by other workers in surveying tuberculosis in Scotland and, therefore, some factor or factors in Lanarkshire must have operated to alter the soil or increase the hazard of infection by the human type of bacillus.

Undoubtedly, it had been agreed that regional variation pointed to a higher incidence of bovine infection in rural areas and Lanarkshire could not be looked upon as rural, at least in those parts where

most of the population was centred. Data were obtained for as many patients as possible to enable an assessment of social conditions to be made and to discover whether any enlightenment on the subject of infection might be gathered from a knowledge of the patient's environment.

To this end I collected the following particulars:-

(a) The number of apartments in the home including kitchen.

(b) The average weekly income.

(c) Any history of tuberculosis in the family or immediate contacts of the patient.

(d) The milk supply.

I then proceeded to analyse each case and to attempt to correlate the clinical condition with the social environment.

For this purpose it was necessary to have standards of housing and of income. Any home having two or more members of the household per apartment I considered substandard and any family trying to live on ten shillings or less per head per week I took as the basis for low economic resources. I cannot conceive how anyone can pay rent, rates, food,

clothing and heating on this figure but as old age pensioners are supposed to exist on this pittance any figure above ten shillings must be taken as adequate.

Substandard Housing in Extrapulmonary Tuberculosis.

A survey of the home conditions of the 311 persons included in this series of extrapulmonary tuberculous infections disclosed that 72.3% resided in overcrowded houses. The proportion in human and in bovine infections was approximately equal with 72.3% and 71.7% respectively.

Incidence of Substandard Housing in Extrapulmonary Tuberculosis.

		Substandard Housing	Total Cases Investigated
General	Human	166 (72.3%)	288
	Bovine	59 (71.1%)	83
		225 (72.3%)	311
Industrial	Human	146 (73.3%)	195
	Bovine	52 (77.6%)	67
		198 (75.9%)	262
Rural	Human	20 (60.6%)	33
	Bovine	7 (43.8%)	16
		27 (55.1%)	49

The industrial area showed a higher percentage of substandard accommodation than the rural area. Of the 262 patients from the industrial area 75.9% lived in overcrowded houses and of the 49 patients from the rural area 55.1% were inadequately housed.

In the industrial area overcrowding was present in the homes of 77.6% of patients with bovine and

of 73.3% of the patients with human infections; in the rural area the percentages for patients was 43.8 of those with bovine and 60.6 of those with human infections.

Incidence of Substandard Housing in Tuberculous Meningitis.

		Substandard Housing	Total Cases Investigated
General	Human	84 (71.2%)	118
	Bovine	34 (72.3%)	47
		118 (71.8%)	165
Industrial	Human	79 (73.1%)	108
	Bovine	31 (79.5%)	39
		110 (74.8%)	147
Rural	Human	5 (50.0%)	10
	Bovine	3 (37.5%)	8
		8 (44.4%)	18

Consideration of the incidence of substandard housing in tuberculous meningitis demonstrated this factor to be present in 71.8% of the 165 cases investigated and that 71.2% of 118 persons with human infections and 72.3% of 47 with bovine infections came from overcrowded houses.

The industrial incidence was 74.8% in 147 patients and the rural 44.4% in 18.

Persons with cervical adenitis had substandard home conditions in 73.6% of the 72 examined with 76%

in 50 human and 68.2% in 22 bovine infections.

Incidence of Substandard Housing
in Tuberculous Cervical Adenitis.

		Substandard Housing	Total Cases Investigated
General	Human	38 (76.0%)	50
	Bovine	15 (68.2%)	22
		53 (73.6%)	72
Industrial	Human	28 (82.4%)	34
	Bovine	14 (77.8%)	18
		42 (80.8%)	52
Rural	Human	10 (62.5%)	16
	Bovine	1 (25.0%)	4
		11 (55.5%)	20

The incidence in the industrial area was 80.8% in 52 cases and in the rural 55.5% in 20 cases. In the industrial area substandard housing was a feature in the histories of 82.4% of the 34 patients with human and in 77.8% of the 18 with bovine infections.

In the rural area, 62.5% of all human infections and 25% of all bovine infections occurred in persons living in overcrowded houses.

In bone and joint infections 72.9% of the 74 subjects affected were from overcrowded dwellings, 73.3% of the 60 human and 71.4% of the 14 bovine infections. The industrial incidence was 73% in 63 cases and the rural 72.7% in 11 cases.

Incidence of Substandard Housing in Bone and Joint Tuberculosis.

		Substandard Housing	Total Cases Investigated
General	Human	44 (73.3%)	60
	Bovine	10 (71.4%)	14
		54 (72.9%)	74
Industrial	Human	39 (73.6%)	53
	Bovine	7 (70.0%)	10
		46 (73.0%)	63
Rural	Human	5 (71.4%)	7
	Bovine	3 (75.0%)	4
		8 (72.7%)	11

The frequency of overcrowding was 73.6% of 53 human and 70% of 10 bovine infections in the industrial area; and, in the rural area, 71.4% of 7 human and 75% of 4 bovine infections.

This analysis showed that substandard housing was a prevalent factor in tuberculous infections and that it was more frequent in industrial than in rural areas. In each infection considered, over 70% of patients in the industrial area lived in overcrowded dwellings; in the rural area 44.4% of patients with tuberculous meningitis, 55.5% of persons with cervical adenitis and 72.7% of cases of bone and joint disease came from overcrowded homes. These figures were much higher than those for the community as a whole and pointed to overcrowding as a substantial factor in the incidence of tuberculosis.

A more critical survey of housing conditions gave further enlightening information. Of patients of one year of age and under in this investigation there were twenty-five in the industrial area and all came from substandard homes. There were 20 with

Housing of Children of 1 Year and under in Extrapulmonary Tuberculosis.

	Apartments. 1	2	3	4	5
Tuberculous Meningitis					
Human	10	2	1	-	2
Bovine	3	-	1	1	-
Cervical Adenitis					
Human	1	-	1	-	-
Bovine	1	-	-	1	-
Bone and Joint					
Human	1	-	-	-	-
Bovine	-	-	-	-	-
	16	2	3	2	2 = 25

No case of extrapulmonary tuberculosis occurred among persons of 1 year or under living in homes with satisfactory accommodation.

tuberculous meningitis, 15 human and 5 bovine infections, 4 with cervical adenitis, 2 human and 2 bovine, and one with bone and joint disease, a human infection. Twelve of the 18 human and 4 of the 7

bovine infections came from single-apartment dwellings.

In the industrial area in satisfactory houses 17.2% of human infections in tuberculous meningitis

Tuberculous Meningitis.

Age and Sex Incidence in Relation to Housing.

Satisfactory

	Age (years) Under 5	-10	-15	-20	Over 20	Total
Human						
Male	2	3	2	9	2	18
Female	-	-	-	3	8	11
	2	3	2	12	10	29
Bovine						
Male	1	2	-	-	-	3
Female	1	-	-	2	2	5
	2	2	-	2	2	8

Substandard

Human						
Male	13	7	4	11	1	36
Female	12	8	4	12	7	43
	25	15	8	23	8	79
Bovine						
Male	5	4	2	1	5	17
Female	6	3	2	2	1	14
	11	7	4	3	6	31

occurred before ten years of age had been reached but

50.4% of human infections occurred before the same age in overcrowded houses showing that the risk of infection was much greater in overcrowded premises for children under ten years of age. The cases in the satisfactorily housed group were all males but the 40 cases in the substandard group showed an equal incidence of males and females.

Bovine infections showed no significant variation in relation to housing conditions.

Rural figures were too small for analysis.

In the industrial area cervical adenitis due to the human tubercle bacillus occurred before ten years of age in 16.7% of the six cases from satisfactory and in 60.7% of twenty-eight cases from overcrowded dwellings; in bovine infections the percentages were 25 of four persons from satisfactory and 50 of fourteen persons from overcrowded dwellings. Infection was equal in the sexes for patients under ten years of age in the substandard group. In the rural area there were no cases of human cervical adenitis under ten years of age among persons living in satisfactory homes; there were 90% of ten cases occurring in substandard houses under ten years of age.

Tuberculous Cervical Adenitis.

Age and Sex Incidence in Relation to Housing.

	Age (years)					
	Under 5	-10	-15	-20	Over 20	Total
Industrial						
Satisfactory						
Human						
Male	-	1	-	-	1	2
Female	-	-	1	2	1	4
	-	1	1	2	2	6
Bovine						
Male	-	-	2	-	-	2
Female	-	1	-	-	1	2
	-	1	2	-	1	4
Substandard						
Human						
Male	6	2	1	2	1	12
Female	3	6	1	2	4	16
	9	8	2	4	5	28
Bovine						
Male	2	1	2	-	1	6
Female	1	3	1	-	3	8
	3	4	3	-	4	14
Rural						
Satisfactory						
Human						
Male	-	-	3	-	1	4
Female	-	-	-	-	2	2
	-	-	3	-	3	6
Bovine						
Male	-	1	-	-	-	1
Female	-	1	-	1	-	2
	-	2	-	1	-	3
Substandard						
Human						
Male	3	3	-	-	-	6
Female	-	3	-	1	-	4
	3	6	-	1	-	10
Bovine						
Male	-	1	-	-	-	1
Female	-	-	-	-	-	-
	-	1	-	-	-	1

In the industrial area human strains of the tubercle bacillus isolated from patients under ten years of age with bone and joint disease were obtained from 14.3% of the fourteen infections in satisfactory and from 28.2% of thirty-nine persons in substandard houses.

Bone and Joint Tuberculosis.

Age and Sex Incidence in Relation to Housing.

Satisfactory

	Age (years) Under 5	-10	-15	-20	Over 20	Total
Human						
Male	1	-	-	4	4	9
Female	-	1	-	2	2	5
	1	1	-	6	6	14
Bovine						
Male	2	-	-	-	-	2
Female	-	-	-	-	1	1
	2	-	-	-	1	3

Substandard

Human						
Male	3	3	1	11	9	27
Female	4	1	-	2	5	12
	7	4	1	13	14	39
Bovine						
Male	1	2	-	1	2	6
Female	-	-	-	-	1	1
	1	2	-	1	3	7

There were too few cases in the rural area for analysis.

Conclusion. From this evidence it was apparent that substandard housing was a most important factor in influencing the incidence of tuberculous infection, particularly in children, and that it was a more important factor in infection with the human strain of the tubercle bacillus than in infection with the bovine strain.

A noteworthy feature of the analysis was the equality of the sex incidence under ten years of age in substandard dwellings and the preponderance of males in satisfactory dwellings.

Investigation of Economic Resources in Extrapulmonary Tuberculosis.

A general survey of the economic resources of the 311 patients with extrapulmonary tuberculosis showed that 117 (44.7%) of the industrial group and 10 (20.4%) of the rural group came from homes where the family income was not greater than ten shillings per head per week.

A more particular examination demonstrated that, with the exception of tuberculous meningitis, low income levels were relatively more prevalent in persons with bovine infection than in those with human infection.

In the industrial area, among patients having low economic resources, 54.5% (42) of those with human infections and 64.5% (20) of those with bovine infections were under ten years of age. These accounted for 57.9% of all cases of extrapulmonary tuberculous infection occurring under ten years of age and for 55.4% of all cases having low economic resources.

In the rural area 70% of all cases with low incomes were under ten years of age. There were 4 persons below the poverty line with bovine infections and 3 (75%) of them were under ten years of age.

Among patients with human infections and with low income levels 4 out of 5 (80%) were under ten years of age. In all infections under ten years of age 34.7% of patients came from homes where money resources were low.

Incidence of Low Economic Resources.

	Industrial		Rural	
	Under 10 years	Over 10 years	Under 10 years	Over 10 years
Tuberculous Meningitis				
Human	26	20	2	-
Bovine	8	5	2	-
	34	25	4	-
Cervical Adenitis				
Human	8	8	2	-
Bovine	8	3	-	1
	16	11	2	1
Bone and Joint Tuberculosis				
Human	8	17	-	1
Bovine	4	2	1	1
	12	19	1	2

Financial impoverishment existed for the most part in homes that were overcrowded for, in the industrial area, there were only 17 out of a total of 117 persons in this series who had satisfactory accommodation at home, and only 1 of 10 in the rural area.

Incidence of Low Economic Resources in Extrapulmonary Tuberculosis.

Industrial Area

	Low Economic Resources	Total
General		
Human	86 (44.1%)	195
Bovine	31 (46.3%)	76
	117 (44.7%)	262
Tuberculous Meningitis		
Human	46 (42.6%)	108
Bovine	13 (33.3%)	39
	59 (40.1%)	147
Cervical Adenitis		
Human	16 (47.1%)	34
Bovine	11 (61.1%)	18
	27 (51.9%)	52
Bone and Joint		
Human	25 (47.2%)	53
Bovine	6 (60.0%)	10
	31 (49.2%)	63

Rural Area

General		
Human	5 (15.2%)	33
Bovine	5 (31.3%)	16
	10 (20.4%)	49

Conclusion. To arrive at any definite conclusion from an examination of income is difficult, for some women are better housekeepers than others and the spending power of money varies from district to district. Furthermore, it is easier to feed a large

family on a relatively more meagre income than is necessary for a small family. The figure I took as my basis for establishing a poverty level was ten shillings or less per head per week and, while this may provide sufficient for a family of seventeen persons, it cannot possibly be sufficient to meet the essential needs of a family of three.

Subsidies are now to be granted to patients once a diagnosis of tuberculosis is established but the damage has been done before the grant is even considered, so that, although relief may be an admirable attempt to safeguard further potential sufferers in the same household, it does little to prevent the ravages of poverty in families with undiagnosed cases of tuberculosis.

It cannot be denied that the deprivation of many of the amenities of life must have added to the risks incurred by overcrowding, particularly in children. The high percentage in persons affected by the bovine strain of the organism seemed to indicate that low economic resources must have a further influence on susceptibility to infection with the tubercle bacillus and it can only be suggested that greater liability to infection comes from a lack of some protection conferred on those more favourably situated financially.

The lower figures for the rural area are interesting for low economic resources are not so important in country districts where food deficiencies are more easily overcome.

As a generalisation it can be said that low economic resources were a factor worthy of note in extrapulmonary tuberculosis, particularly in children, and more especially in infection with the bovine strain of the tubercle bacillus.

In older persons it was often the case that loss of earning capacity due to tuberculous infection was the cause of the lack of income and, therefore, to deduce any factor of significance from its presence would be to invite argument. The children under consideration had not reached an age at which they were employable and so this probability did not need to be taken into account in estimating the importance of poverty in childhood tuberculosis.

There can be no doubt that for children in the homes of impoverished, tuberculous adults the risk from lowered resistance must aggravate the danger of possible massive infection with the tubercle bacillus.

The Influence of Domestic or Personal History in Tuberculous Infections.

A history of contact with other tuberculous persons in the home or of previous manifestation of tuberculous disease in the patient was obtained from 108 of the 311 subjects considered in the investigation of extrapulmonary tuberculosis.

Distribution of History of Tuberculosis.

	Tuberculous Meningitis		Cervical Adenitis		Bone and Joint Tuberculosis	
Industrial Area	Human	Bovine	Human	Bovine	Human	Bovine
Contact Pul.	29	2	14	-	13	-
Patient Pul.	8	-	3	1	7	1
Contact Non-pul.	-	4	-	2	-	2
Patient Non-pul.	-	3	-	-	5	-
	37	9	17	3	25	3
Total cases	108	39	34	18	53	10
Rural Area						
Contact Pul.	2	2	3	-	4	-
Patient Pul.	-	-	-	-	1	-
Contact Non-pul.	-	-	-	-	-	1
Patient Non-pul.	-	-	1	-	-	-
	2	2	4	-	5	1
Total cases	10	8	16	4	7	4

Pul. = Pulmonary tuberculosis
Non-pul. = Non-pulmonary tuberculosis

In the industrial area, patients coming from homes where other members of the household had

suffered from pulmonary tuberculosis and had, therefore, a probable source of infection with the human type of tubercle bacillus numbered 29 out of 108 human infections in tuberculous meningitis, 14 of 34 human infections in cervical adenitis and 13 of 33 human infections in cases of bone and joint disease.

This gave a total of 56 persons out of 195 in whom the probable source of infection was an adult in the household with pulmonary tuberculosis.

In the rural area the total was 9 out of 53 cases infected with the human strain of tubercle bacillus and was made up of 2 of 10 cases of tuberculous meningitis, 3 of 16 of tuberculous cervical adenitis and 4 of 7 of tuberculous bone and joint disease.

Pulmonary tuberculosis was in the family history of 2 of the 67 bovine infections occurring in the industrial area and those were 2 out of 39 cases of tuberculous meningitis. In the rural area 2 of 8 cases of tuberculous meningitis due to the bovine type of bacillus had relations suffering from pulmonary tuberculosis.

A history of contact with a case of non-pulmonary tuberculosis in the home was present in 8 patients in the industrial area and in 1 in the rural area. All these persons were suffering from infections due to

the bovine type of bacillus and were in the industrial area, 4 with tuberculous meningitis, 2 with cervical adenitis and 2 with bone and joint disease; the rural case was a patient with bone and joint disease and whose sister suffered from abdominal tuberculosis.

A further group of patients had other tuberculous lesions than those for which they were included in this investigation.

In the groups due to the human strain of organism 8 patients with tuberculous meningitis, 3 with cervical adenitis and 7 with bone and joint infection were proved cases of pulmonary tuberculosis and 5 other patients with bone and joint disease suffered from multiple lesions. These persons were from the industrial area. In the rural area a patient with bone and joint disease, from whom the human type of bacillus was isolated, had pulmonary tuberculosis as well and a patient with cervical adenitis due to the human bacillus also suffered from a tuberculous infection of the spine.

In the rural area no cases with bovine infections had other manifestations of tuberculosis, but five personal histories were obtained from patients in the industrial area; 3 cases of tuberculous meningitis suffered from extrapulmonary lesions, a patient with

cervical adenitis and a patient with bone and joint disease also had pulmonary tuberculosis.

It is interesting that two patients with bovine infections came from farms. A dairymaid died of tuberculous meningitis and a dairy farmer's son aged six years was under treatment for tuberculous cervical adenitis.

Conclusion. These findings go far to explain the higher incidence of human infections in cervical adenitis in Lanarkshire for 50% of the cases in the industrial area had a family or personal history of pulmonary tuberculosis.

In bone and joint infections in the rural area 71.4% of the persons infected with the human strain of organism had a history of pulmonary tuberculosis in the household.

No patient with cervical adenitis or with bone and joint disease due to the bovine type of bacillus gave a history of having contact with any person in the household suffering from pulmonary tuberculosis. One patient in the industrial area suffering from tuberculosis of the spine also had a pulmonary infection.

It was, therefore, evident that a history of

pulmonary tuberculosis either in a contact or in the patient was not only an important factor in the incidence of extrapulmonary tuberculosis due to the human strain of tubercle bacillus but it was also a factor influencing the regional variation.

The Influence of Milk Supply in Infection with the Bovine Strain of the Tubercle Bacillus.

In all extrapulmonary cases in the industrial area, of the 67 persons with bovine infections, 51 took raw milk (ungraded) from suppliers of sweet milk and 16 had the local Co-operative Societies as suppliers. Co-operative milk is sold as sweet milk and may or may not be pasteurized.

In rural areas Co-operative milk is raw, except in a few districts where pasteurized milk is supplied, unless climatic conditions make transport impossible. In this exigency raw milk is diverted for local delivery until communication routes are reopened.

Milk consumed by 15 of the 16 persons with bovine infections in the rural area was raw and not designated; one patient with tuberculous meningitis took Co-operative milk that was pasteurized. This patient, a female of four years, had an aunt with pulmonary tuberculosis but unfortunately the organism from the phthisical case was not obtained for typing.

The risk of more massive infection from milk is greater in rural than in urban areas for supplies usually come from one farm and are not mixed before distribution.

Age Incidence in Bovine Infection. In all infections

in the industrial area 16 out of 19 patients (84.2%) under five years of age took raw milk and three took Co-operative pasteurized milk. Of the 17 patients between five and ten years of age, 11 (64.7%) consumed raw milk and the remaining 6 (35.3%) took Co-operative pasteurized milk. From this it will be seen that over half of the patients with bovine infections were under ten years of age and that 75% of those persons took untreated and undesignated milk. The patients who consumed pasteurized milk obtained supplies from shops that retailed in the most part bulk milk from two plants that were found inefficient, but this point will be discussed later.

In older persons it is doubtful whether an inquiry into milk supply is of much value for patients may consume any kind of milk outside the home and the fact that one particular supply is taken by a household means nothing unless a patient is confined to the house. Nevertheless, 24 out of the 31 affected persons above ten years of age (77.4%) were supplied with raw milk and the others had Co-operative milk.

The particular analysis for the respective diseases in this inquiry gave even more significant results than those of a general survey.

Meningitis was a terminal manifestation in three

patients with other clinically recognised lesions and, in several cases in which permission was obtained for post-mortem examination, abdominal tuberculosis was discovered as the primary seat of infection.

Milk Supply in Bovine Infections in Industrial Area.

Disease	Milk Supply	Age (years) Under 5	-10	-15	-20	-25	-30	-40
Tuberculous Meningitis	Co-op.	2	5	2	1	1	-	-
	Raw	12	4	2	4	4	-	2
Cervical Adenitis	Co-op.	-	1	-	-	-	-	1
	Raw	3	5	4	1	2	1	-
Bone and Joint Tuberculosis	Co-op.	1	-	-	-	2	-	-
	Raw	1	2	-	1	3	-	-

Raw milk was supplied to 71.8% of the 39 persons with tuberculous meningitis from whom bovine strains were isolated.

In the subjects with cervical adenitis due to the bovine bacillus 16 out of 18 took raw milk (88.9%) and 7 of the 10 cases of bone and joint disease were supplied with raw milk (70%).

Discussion. It was apparent that milk was a very definite possible source of infection in patients harbouring the bovine strain of tubercle bacillus, for, although no attempt was made to correlate milks

proved to contain tubercle bacilli with cases of bovine infection in this series, it was known that such milks must have been ingested by many of the persons affected.

During the period of this investigation I found tubercle bacilli in bulk milk from two of the three Co-operative pasteurization plants in the industrial area, plants from which the majority of consumers of Co-operative pasteurized milk were supplied. In each case inspection and examination of the plant showed it to be obsolete and ineffective in action and, as a result, replacement by new and efficient apparatus followed.

With the exception of Rutherglen, all the Burghs and most of the industrial area of the Landward County of Lanark derive milk from these two sources. It is significant that the only case of tuberculosis due to the bovine bacillus in consumers of Co-operative milk in the area supplied from the third pasteurization plant was a female of twenty years of age who suffered from tuberculous meningitis as a terminal manifestation in miliary tuberculosis.

The Co-operative Societies retailing milk sold it as 'Sweet' milk and many of them also retailed untreated milk so that, apart from the probability of

infection from the inadequately pasteurized milks, the possibility of infection from raw milk supplied by Co-operative Societies cannot be overlooked.

Dairy farming is the principal occupation in the rural areas in the County of Lanark and there are 1,255 herds registered to produce milk for sale. Of this number 14 are licenced to produce 'Certified' milk, 246 hold 'Tuberculin-Tested' herd licences and 265 are 'Standard' producers. Many in the last designated category are herds that have failed to pass the tuberculin-test on application for the higher grade of licence.

Of the 1,255 herds 260 are safe according to designation but I have found tubercle bacilli in several milks from tuberculin-tested herds and in one instance the veterinary inspector subsequently removed five animals with tuberculosis from a herd although the farmer had held a licence for not longer than three months prior to the sampling of the bulk milk. This experience is unusual but it has happened on more than one occasion.

As well as registered herds there are many small places where a cow or a few cows are kept and milk may be given to neighbours but, in this investigation I have no record of any patient with tuberculosis who

obtained milk from this source.

It is of passing interest to know that during the period of this inquiry I examined samples of bulk milk produced in the County of Lanark and found the results tabulated below.

Biological Examination of Bulk Milk for the Presence of Tubercle Bacilli.

	Results Obtained	Positive
1937	705	49 (7.0%)
1938	638	41 (6.4%)
1939	648	69 (10.7%)
1940	210	12 (5.7%)
1941	964	39 (4.0%)
1942	496	28 (5.7%)

The figures for milk examination are those of milks sampled in the Landward Area of the County and do not include any taken in the large burghs or any 'Certified', 'Tuberculin-Tested' or 'Pasteurized' milks. Until the introduction of the designation 'Standard' the milks examined were 'Grade A' or 'Sweet'.

Since 1939 almost all milks examined have been 'Standard' and the percentage of positive findings is lower than the actual incidence as many of the

negative samples were repeated on account of their failure to pass the bacteriological standard of cleanliness and positive samples were repeated after the removal of tuberculous animals from the herd. Apart from this source of error in favour of the milk supply, during the past four years, almost none of the 730 ordinary herds have been sampled.

Outwith the figures given for milk examinations in the Landward Area, samples from retailers in other districts of the County have given 'positive' results and, as many handle mixed milks the incidence of infecting milks is undoubtedly higher than the incidence found among bulk milks collected at individual farms.

To obtain a true index of the tuberculous contamination of the milk supply in Lanarkshire would entail more work than there is staff available to accomplish at the present time.

The circumstantial evidence for infection from milk in cases of extrapulmonary tuberculosis due to the bovine bacillus was very strong but not proved conclusively by these findings.

SUMMARY.

In this investigation the hitherto unexplored field of tuberculous Lanarkshire has been surveyed.

The relative incidence of human and bovine strains of the tubercle bacillus in 80 cases of pulmonary tuberculosis and in 311 cases of extrapulmonary tuberculosis has been examined. Results have shown that bovine infections were present in 2.5% of the pulmonary cases, a figure that is in keeping with the expected incidence for an area as highly industrialised as Lanarkshire.

The extrapulmonary strains have been further subdivided into 165 strains isolated from patients suffering from tuberculous meningitis, 72 strains isolated from patients with cervical adenitis and 74 strains from patients with tuberculous lesions affecting bone or joint. Each group has been analysed separately.

In the 165 cases of tuberculous meningitis bovine infections accounted for 28.5% of the total. This figure was slightly higher than the 22% given by Blacklock and Griffen (1935) for the Glasgow area and the 24% of Macgregor and Green (1937) for the Edinburgh area but it was lower than the 36% found by

Munro and Scott (1936) in the East of Scotland and the 40.5% given for Scotland by Griffith (1934) in his general survey. The greater preponderance of bovine infections in rural areas supported the observations of these workers.

The cervical adenitis group gave the percentage of bovine infections as 30.4, a result much lower than any previously published for Scotland but there can be no doubt that a family history of pulmonary tuberculosis obtained from 50% of the patients in the industrial group who supplied human strains must have been a most important factor in influencing the relative incidence of the two types of tubercle bacillus. There were 72 cases of cervical adenitis investigated and 52 came from the industrial area.

Seventy-four patients suffering from tuberculous lesions affecting bone or joint gave a bovine incidence of 18.9%, a percentage that is lower than that given by Munro and Cumming (1926) of 36.4% but approximating to the 20.5% given by Wang (1917) for the Edinburgh area. Munro and Cumming were dealing with a less industrialised area than Lanarkshire which probably accounts for the variation as also does the fact that, of 7 human cases occurring in the rural part of Lanarkshire, 5 gave a family history of

pulmonary tuberculosis.

These figures only serve to substantiate observations of regional variation and endorse the findings of other workers who have found a lower proportion of bovine infections in industrial districts. As Lanarkshire is the most highly industrialised county in Scotland it was to be expected that the results of this investigation might have given an even greater predominance of human infection than actually was found.

In an attempt to discover the factors that could influence regional variation and give a higher incidence of human infections, an examination of social environment as a likely source of information regarding a variation in soil rather than seed was followed along avenues that might lead to some enlightenment.

Many interesting facts emerged from an analysis of housing conditions and economic resources.

Taking as a basis for substandard housing the accommodation of two or more persons per apartment, and including the kitchen as an apartment, it was found that, in the extrapulmonary cases of tuberculosis, 225 of the total of 311 cases investigated came from overcrowded dwellings.

The relative frequency of overcrowding was higher in the homes of patients in the industrial area than it was in the rural area, and further that, in the industrial area, it was a more constant finding when more critical scrutiny allowed the incidence to become particular for the various manifestations of tuberculosis already discussed in the extrapulmonary group.

In a general analysis of cases in the industrial area it was found that 75.9% of patients came from substandard homes and, in a particular analysis, it was still found that over 73% of patients with each disease, tuberculous meningitis (74.8%), cervical adenitis (80.8%) and bone and joint disease (73%), came from substandard homes. The further subdivision of each subgroup into human and bovine types of infection had very little effect on the relative incidence of overcrowding.

In rural areas the general incidence of substandard housing among patients was 55.1% but this figure was greatly influenced by the majority of persons suffering from bone and joint disease being inadequately housed; 72.7% of those persons lived in overcrowded dwellings and there was no appreciable difference in human and bovine infections.

In patients with tuberculous meningitis and tuberculous cervical adenitis overcrowding was much more prevalent in those with human infections than in those with bovine infections.

Examination of age incidence in extrapulmonary tuberculosis in relation to substandard housing showed that all patients of one year of age and under in the industrial area, twenty-five in all, came from homes where overcrowding prevailed and that sixteen of them came from single apartment dwellings.

That the risk of infection in childhood was much greater in substandard homes than in satisfactory homes was shown by an analysis of human infections occurring before ten years of age had been reached.

In the industrial area 50.4% of human infections in patients with tuberculous meningitis, and coming from overcrowded homes, occurred before the tenth year of life had been completed but only 17.2% of similar infections took place among the patients from satisfactory homes.

The sex incidence also showed a remarkable variation, for the smaller percentage from good homes were all males and the larger percentage from overcrowded dwellings showed an equal liability to infection in the sexes.

Bovine infections showed no significant variation in relation to housing conditions.

Patients under ten years of age with cervical adenitis showed the same variation in occurrence in human infections. 16.7% of all cases from satisfactory homes and 60.7% of all cases from substandard homes were under ten years of age and again the change from male infection to equality of infection in males and females was noted.

Bovine infections also showed a higher relative proportion among children under ten years of age in substandard houses but the variation was not so great as in human infections. Again infection was equal for the sexes.

In bone and joint disease, patients under ten years of age accounted for 14.3% of all patients with human strains residing in satisfactory dwellings and 28.2% of those living under conditions of overcrowding. The sexes were equally affected in both groups.

Bovine infections showed no difference in relation to housing.

In the rural areas numbers were too small for analysis but it is noteworthy that while there were no cases of cervical adenitis due to the human strain of tubercle bacillus in persons under ten years of

age and living in satisfactory homes, 90% of the patients from substandard houses with human infections were under ten years of age.

This analysis revealed several important facts.

Overcrowding was a factor in the lives of the majority of patients from the industrial area and, from the evidence, it was a most important factor in influencing the incidence of infection with the tubercle bacillus, particularly in children. It swayed the balance of the sex incidence so that infection in females became as frequent as in males.

This was entirely in infections with the human type of tubercle bacillus, for bovine figures showed nothing significant in relation to housing conditions.

In the rural areas, where substandard housing was not so common, figures were too small for an age analysis to be made but it was a feature that, generally, overcrowding was more prevalent in human infections than in bovine.

Examination of the financial resources of patients suffering from extrapulmonary tuberculosis showed that economic hardship was more prevalent in industrial districts for 44.7% of the 262 persons residing in the industrial area and 20.4% of the 49 living in the rural area had weekly family incomes of

ten shillings or less per head.

A more critical analysis showed that, in the industrial area, over half of the patients (55.4%) who came from homes where the family income was below the poverty line were children under ten years of age and those children comprised 52.1% of all children under ten years of age with extrapulmonary tuberculous lesions.

The incidence was relatively higher among those with bovine infections than it was among those with human lesions.

A particular survey of rural patients was of little value on account of the small number of cases considered but it was significant that 70% of patients with low economic resources were under ten years of age.

The majority of patients coming from families with low incomes lived in overcrowded houses but the high percentage of children under ten years with bovine infections seemed to indicate that some factor apart from overcrowding had an influence on susceptibility to infection with the tubercle bacillus possibly through the deprivation of some necessary protection that was acquired by those more adequately supplied with the amenities of life.

It can at least be said that, although it was difficult to assess any exact influence of low economic resources in addition to the unquestionable danger of proximity of contacts in overcrowded dwellings in human infections in children, there was evidence to point to the added influence of poverty in the susceptibility of children to infection with the bovine strain of tubercle bacillus.

A history of contact with previously recognised cases of tuberculosis in the home, or of earlier manifestations of tuberculous disease in the patient, was obtained from 108 of the 311 persons examined.

More detailed investigation revealed evidence that contributed a possible explanation of the high incidence of human infections in tuberculous cervical adenitis and bone and joint disease.

The presence of other members of the household suffering from non-pulmonary tuberculosis occurred only in 8 patients from all of whom the bovine strain of tubercle bacillus was isolated and was an interesting feature of this analysis for, while the probability of case to case infection might be doubtful, the possibility of a common source of infection could not be dismissed.

Pulmonary tuberculosis in immediate home contacts

was found to be proved in 58 persons in the industrial area and in 11 persons in the rural area.

A further 20 persons in the industrial area and one rural patient with bone and joint tuberculosis had pulmonary as well as extrapulmonary lesions.

It was shown that, of patients from whom the human type of the tubercle bacillus was isolated, 50% of those with cervical adenitis who came from the industrial area had a family or personal history of pulmonary tuberculosis and that, in the rural area, in 71.4% of persons suffering from bone and joint disease there was a history of pulmonary tuberculosis in the household.

These figures show that the possibility of droplet infection with the human type of bacillus was a frequent hazard in a known high percentage of those two diseases and was a probable cause of the preponderance of human infections in the series of cases investigated.

The importance of milk supply as a possible reason for regional variation in the type of infecting organism in tuberculous disease has long been stressed by many workers and Macgregor and Green (1937) suggested that, in further investigations, this subject should be recorded.

To establish the exact time of the primary infection with the tubercle bacillus is impossible and, for that reason, no attempt has been made in this inquiry to correlate examinations of milk supplies for the presence of tubercle bacilli with bovine infections in patients. The kind of milk normally consumed by the patient in his own home was ascertained and it was astonishing to find such overwhelmingly convincing evidence of the probability of milk as the source of infection in patients from whom bovine strains of the tubercle bacillus were isolated.

Every patient in this series consumed either raw, undesignated milk or milk supplied by the local Co-operative Society which, though sold as undesignated in most places, was very often pasteurized. That the pasteurization was inadequate was proved during this investigation by the finding of tubercle bacilli in the milk.

The importance of milk supply in extrapulmonary tuberculosis was shown by the fact that over half of the patients with bovine infections were under ten years of age and that 75% of those persons consumed raw milk; the remainder took Co-operative milk that was either raw or was known to have contained tubercle bacilli after pasteurization.

In a particular analysis of the several manifestations of extrapulmonary tuberculosis occurring among patients in the industrial area, even more significant pointers to milk as the source of infection in human tuberculosis due to the bovine type of organism were forthcoming for raw milk was supplied to 71.8% of the 39 persons with tuberculous meningitis, to 88.9% of those with cervical adenitis and to 70% of those with bone and joint disease. All others consumed Co-operative milk.

From these findings it was possible to conclude that all the social factors considered were important in determining the incidence of tuberculosis in children and of the type of infecting strain of tubercle bacillus. Substandard housing and history of contact were more important in infections with the human strains; income and milk supply in infections with bovine strains of the tubercle bacillus.

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APPENDIX

The following lists give details of the patients included in the survey of extrapulmonary tuberculosis. They show in tabular form the data concerning each patient.

The sex and age of the patient and the number of inmates in the household are shown in the first three columns. In column four, an average weekly income of ten shillings or less per head is indicated by a plus sign and any amount above this figure is designated by the minus sign.

The kind of milk consumed by the patient is shown in column five, the word Co-op. showing that supplies were obtained from Co-operative Societies. In some instances this information was indefinite and has not been included.

A personal history of pulmonary tuberculosis or of contact with a member of the household suffering from pulmonary tuberculosis is designated by the contraction 'Pul'. 'Non-pul' indicates that the patient suffered from some other extrapulmonary lesion or that another member of the household suffered or had suffered from extrapulmonary tuberculosis.

The type of tubercle bacillus isolated from each

patient is shown by 'H' for a human and 'B' for a bovine strain.

Groups have been drawn up according to the number of apartments in the home.

Those patients in 'institutions' were not in on account of tuberculosis but were either persons domiciled in schools, persons on staffs of hospitals or, in one instance, a mental patient. All were from home addresses in the industrial area of the County of Lanark.

No evacuees or service personnel temporarily accommodated in the area have been included in this investigation.

PATIENTS SUFFERING FROM TUBERCULOUS MENINGITIS.

	Sex	Age	Inmates	Income	Milk	Type	History
Industrial Area							
Satisfactory Housing							
2 apartments	M	13	3	-	-	H	-
	M	2	3	-	Co-op.	H	-
	M	18	3	-	T.T.	H	-
	F	24	2	-	-	H	-
3 apartments	F	20	4	-	Raw	H	-
	M	15	5	+	Co-op.	H	-
	M	17	4	-	-	H	Pul.
	F	52	2	-	Co-op	H	-
	M	16	3	-	Raw	H	Pul.
	M	16	5	-	Raw	H	Pul.
	M	16	5	+	Raw	H	-
	F	21	2	+	Co-op.	H	Pul.
	M	5	3	-	Raw	B	-
	F	15	5	-	Raw	B	-
	F	20	3	-	Raw	B	-
	F	3	3	-	Raw	B	-
	M	8	5	-	Co-op.	B	-
	M	2	3	+	Co-op.	B	Non-pul.
4 apartments	M	18	5	+	Past.	H	-

	Sex	Age	Inmates	Income	Milk	Type	History
	F	15	7	+	-	H	-
	F	24	7	-	-	H	Pul.
	M	8	6	+	Co-op.	H	-
	M	60	3	-	Co-op.	H	-
	M	17	5	-	Past.	H	-
	M	9	6	-	Raw	H	-
	M	5	3	+	-	H	Pul.
	F	21	5	-	Raw	H	-
	F	15	7	-	T.T.	H	Pul.
	F	4	4	-	Raw	B	-
	F	16	7	-	Raw	B	-
5 apartments	M	59	9	-	Co-op.	H	Pul.
	M	14	7	-	Co-op.	H	Pul.
	M	17	5	-	Co-op.	H	-
	M	1	3	-	Co-op.	H	-
Institutions	F	17	-	-	Cert.	H	Pul.
	F	15	-	-	-	H	Pul.
	F	40	-	-	Cert.	H	Pul.
Substandard Housing							
1 apartment	M	11	8	+	Past.	H	-
	M	7 mths.	3	+	Past.	H	-
	F	20	7	+	-	H	-

	Sex	Age	Inmates	Income	Milk	Type	History
	F	1	4	-	T.T.	H	-
	F	1	5	+	Co-op.	H	-
	M	1	3	-	Co-op.	H	-
	F	1	4	+	-	H	Pul.
	F	1	3	-	Co-op.	H	-
	F	18	4	-	T.T.	H	Pul.
	F	11 mths.	7	+	Co-op.	H	-
	M	11 mths.	8	+	Raw	H	Pul.
	M	3	5	+	Co-op.	H	-
	M	7 mths.	4	-	-	H	Pul.
	F	1	4	-	-	H	Pul.
	F	19	7	-	-	H	-
	F	11 mths.	3	+	Raw	B	-
	F	4	5	-	Raw	B	-
	F	6	6	-	Co-op.	B	-
	M	33	4	-	Raw	B	-
	F	2 mths.	5	-	Raw	B	-
	M	7 mths.	7	+	Raw	B	-
	M	3	5	+	Raw	B	-
2 apart-ments	F	15	5	-	T.T.	H	-
	F	14	5	-	Co-op.	H	-
	F	20	8	-	-	H	Pul.
	F	21	4	-	Co-op.	H	Pul.

Sex	Age	Inmates	Income	Milk	Type	History
M	18	4	-	Co-op.	H	-
M	19	5	-	-	H	Pul.
F	8	5	-	Raw	H	-
F	15	5	-	Raw	H	-
M	8	9	-	Co-op.	H	-
M	16	5	-	Raw	H	-
M	17	6	-	Co-op.	H	-
M	2	8	+	Raw	H	Pul.
M	4	5	-	Raw	H	-
F	16	8	-	-	H	Pul.
F	27	6	+	Past.	H	-
F	6	6	-	Past.	H	-
F	15	6	-	Past.	H	-
F	19	8	-	Raw	H	-
F	21	8	-	Raw	H	-
M	40	8	+	Raw	H	-
F	5	11	+	Raw	H	-
F	9	7	+	Raw	H	-
F	2	6	+	Raw	H	-
F	20	7	-	Co-op.	H	-
M	6	6	-	Raw	H	Pul.
F	18	7	+	Raw	H	-
M	19	4	+	-	H	-
F	12	6	+	T.T.	H	-

Sex	Age	Inmates	Income	Milk	Type	History
M	1	5	+	Co-op.	H	Pul.
F	3	4	+	Raw	H	-
F	19	9	+	Raw	H	Pul.
M	15	6	-	Co-op.	H	-
F	1	4	+	Past.	H	-
M	10	10	-	-	H	-
F	13	5	-	-	H	Pul.
M	2	7	+	Raw	B	-
F	20	4	-	Co-op.	B	Non-pul.
F	2	7	+	Raw	B	-
F	8	5	-	Raw	B	-
M	14	8	+	Co-op.	B	-
M	39	5	-	Raw	B	Pul.
F	10	4	-	Co-op.	B	-
M	22	5	-	Raw	B	Non-pul.
M	5	8	-	Raw	B	-
F	2	6	-	Raw	B	-
M	11	5	+	Raw	B	-
F	13	9	+	Raw	B	-
M	9	7	+	Co-op.	B	Non-pul.
M	20	5	-	Raw	B	Non-pul.
M	15	6	-	Raw	B	-
F	5	4	-	Co-op.	B	-
M.	20	9	-	Raw	B	-

	Sex	Age	Inmates	Income	Milk	Type	History
	M	6	8	-	Co-op.	B	-
3 apart-ments	M	12	8	+	Co-op.	H	-
	F	7	9	+	Past.	H	-
	M	17	7	+	Co-op.	H	-
	M	2	8	+	Co-op.	H	-
	F	5	13	+	-	H	-
	F	15	6	-	Raw	H	-
	F	17	10	-	T.T.	H	Pul.
	F	7	7	+	Co-op.	H	-
	M	11 mths.	6	-	Co-op.	H	-
	F	11	7	-	Co-op.	H	-
	M	8	8	-	Co-op.	H	-
	M	6	11	+	-	H	Pul.
	F	12	7	-	Co-op.	H	-
	F	15	11	-	Raw	H	-
	M	7	6	+	Raw	H	-
	F	45	7	+	Co-op.	H	Pul.
	M	18	7	-	Co-op.	H	Pul.
	M	2	6	-	Past.	H	-
	M	5	6	-	Past.	H	Pul.
	M	6	8	-	Raw	B	-
	M	11 mths.	8	-	Raw	B	Pul.
	F	17	8	+	Co-op.	B	Non-pul.

	Sex	Age	Inmates	Income	Milk	Type	History
4 apart-ments	F	2	9	+	Past.	H	Pul.
	M	7	9	-	Co-op.	H	Pul.
	M	14	8	-	Co-op.	H	-
	F	15	8	+	Co-op.	H	Pul.
	M	16	10	+	-	H	Pul.
	M	17	9	+	Co-op.	H	-
	M	19	9	-	Raw	H	-
	F	4	8	+	Raw	H	-
	M	6 mths.	9	-	Raw	B	-
5 apart-ments	M	7 mths.	13	+	Co-op.	H	Pul.
	M	1	11	+	Co-op.	H	Pul.
	F	16	10	+	Raw	B	Non-pul.
	F	4	11	+	Co-op.	B	-

Rural Area

Satisfactory Housing

2 apart-ments	M	23	2	-	Raw	B	-
3 apart ments	F	2	4	-	Co-op.	H	-
	F	1	5	-	Past.	H	-
	F	4	4	-	Raw	B	-
	M	34	5	-	Co-op.	B	Pul.
4 apart-ments	M	13	6	-	Co-op.	H	Pul.

	Sex	Age	Inmates	Income	Milk	Type	History
	M	9 mths.	5	-	Co-op.	B	-
5 apartments	F	17	3	-	Co-op.	H	-
	F	19	8	-	Raw	B	-
6 apartments	M	1	3	-	Cert.	H	Pul.
Substandard Housing							
1 apartment	M	14	5	-	Raw	H	-
	F	12	3	-	Co-op.	H	-
	F	4	4	+	Co-op.	B	Pul.
2 apartments	F	16	4	-	Co-op.	H	-
	M	14 mths.	8	+	Raw	H	-
3 apartments	M	3	6	-	Co-op.	B	-
	F	7	11	+	Raw	B	-
4 apartments	F	3	9	+	Co-op.	H	-

PATIENTS SUFFERING FROM TUBERCULOUS CERVICAL ADENITIS.

	Sex	Age	Inmates	Income	Milk Type		History
Industrial Area							
Satisfactory Housing							
2 apartments	F	11	3	+	Co-op.	H	Pul.
3 apartments	M	30	5	-	Co-op.	H	-
	F	26	5	-	Raw	B	-
	F	6	4	+	Raw	B	-
4 apartments	F	16	7	+	-	H	-
	M	14	6	-	Raw	B	-
5 apartments	M	7	5	+	-	H	Pul.
	M	13	5	-	Raw	B	-
Institutions	F	16	-	-	-	H	Pul.
	F	29	-	-	T.T.	H	Pul.
Substandard Housing							
1 apartment	M	7	4	+	Raw	H	-
	M	13	4	-	Co-op.	H	-
	M	4	4	-	Co-op.	H	-
	F	9	6	+	Raw	H	Pul.
	M	4	4	-	Raw	H	-
	F	28	3	+	Co-op.	H	-

	Sex	Age	Inmates	Income	Milk	Type	History
	M	2	4	-	Co-op.	H	Pul.
	M	18	5	+	Co-op.	H	Pul.
	M	1	3	-	Raw	H	Pul.
	F	1	3	+	Raw	B	-
	F	24	6	-	Raw	B	-
	F	11	4	+	Raw	B	-
2 apart-ments	F	6	7	+	Co-op.	H	-
	M	3	8	-	Past.	H	-
	F	30	7	+	Raw	H	-
	F	5	5	+	Co-op.	H	-
	M	57	4	+	Raw	H	Pul.
	F	46	4	+	Co-op.	H	Pul.
	F	24	7	-	Raw	H	Pul.
	M	5	5	-	Past.	H	Pul.
	F	17	4	-	Co-op.	H	-
	F	1	5	-	Raw	H	Pul.
	F	7	5	-	Co-op.	H	-
	F	8	4	-	Co-op.	H	-
	M	29	5	+	Raw	B	Pul.
	M	34	4	-	Co-op.	B	-
	M	10	8	+	Raw	B	-
	F	9	7	+	Raw	B	-
	F	8	8	+	Raw	B	Non-pul.

	Sex	Age	Inmates	Income	Milk	Type	History
	M	8	6	+	Raw	B	-
	F	20	6	-	Raw	B	-
3 apartments	F	3	10	+	Raw	H	-
	M	1	6	-	Co-op.	H	Pul.
	F	16	9	-	-	H	Pul.
	F	4	9	+	Raw	H	Pul.
	M	16	9	-	T.T.	H	-
	M	2	9	+	Raw	B	Non-pul.
	F	9	7	+	Co-op.	B	-
	M	13	7	-	Raw	B	-
4 apartments	M	7	8	+	Raw	H	-
	M	10	10	+	Raw	H	Pul.
	M	1	8	+	Raw	B	-

Rural Area

Satisfactory Housing

1 apartment	M	28	1	-	Raw	H	-
2 apartments	M	13	3	-	Raw	H	Pul.
	F	22	2	-	Co-op.	H	-
3 apartments	F	6	4	-	Raw	B	-
4 apartments	M	12	4	-	Raw	H	-
	M	11	5	-	Raw	H	-

	Sex	Age	Inmates	Income	Milk	Type	History
	F	19	5	+	Raw	B	-
5 apartments	F	52	4	-	Co-op.	H	Non-pul.
8 apartments	M	6	6	-	Raw	B	-
Substandard Housing							
1 apartment	M	6	5	+	T.T.	H	-
	M	4	4	-	Raw	H	-
2 apartments	M	3	4	-	Raw	H	-
	F	7	6	-	Raw	H	-
	M	15	8	-	Raw	H	Pul.
	M	6	6	+	Raw	H	-
	M	2	4	-	Co-op.	H	Pul.
	F	6	5	-	Raw	H	-
	M	5	4	-	Raw	B	-
3 apartments	M	5	6	-	Raw	H	-
	F	9	7	-	Raw	H	-

PATIENTS SUFFERING FROM BONE AND JOINT TUBERCULOSIS.

	Sex	Age	Inmates	Income	Milk	Type	History
Industrial Area							
Satisfactory Housing							
2 apartments	F	55	2	-	Co-op.	H	Non-pul.
	M	20	3	-	-	H	-
	M	2	3	+	Raw	B	-
3 apartments	M	47	3	-	Raw	H	-
	M	16	5	+	-	H	Pul.
	M	19	4	+	Co-op.	H	Non-pul.
4 apartments	M	43	7	+	-	H	Pul.
	F	21	6	-	-	H	Pul.
	F	9	3	-	T.T.	H	-
	M	20	4	-	-	H	Pul.
	M	4	7	-	Raw	H	-
	F	24	7	-	Raw	B	-
5 apartments	F	18	9	-	Co-op.	H	Pul.
	M	17	8	+	Co-op.	H	Pul.
	F	19	7	-	Co-op.	H	-
	M	17	8	+	Co-op.	H	Pul.
	M	2	9	+	Co-op.	B	Non-pul.

	Sex	Age	Inmates	Income	Milk	Type	History
Substandard Housing							
1 apartment	F	3	4	+	Raw	H	Pul.
	M	7	6	+	Raw	H	-
	M	17	3	-	Co-op.	H	-
	M	19	7	+	Co-op.	H	-
	F	4	5	+	Co-op.	H	-
	F	39	6	+	Raw	H	-
	M	10 mths.	4	-	Raw	H	Non-pul.
	M	6	4	+	Co-op.	H	-
	M	6	8	+	Raw	B	Non-pul.
	M	22	5	-	Co-op.	B	Pul.
	M	3	5	+	Co-op.	B	-
	F	21	8	+	Co-op.	B	-
2 apartments	F	2	8	+	Co-op.	H	-
	M	18	9	+	Raw	H	-
	M	18	12	-	Raw	H	-
	M	2	4	-	Co-op.	H	Pul.
	F	26	6	+	Co-op.	H	Non-pul.
	F	2	4	+	Raw	H	Pul.
	M	29	6	+	-	H	Pul.
	M	15	8	-	Raw	H	-
	F	19	9	+	Raw	H	Pul.
	M	25	6	+	Co-op.	H	-

	Sex	Age	Inmates	Income	Milk	Type	History
	M	2	5	-	-	H	Pul.
	M	19	6	-	Co-op.	H	-
	M	20	4	-	Raw	H	-
	F	30	5	-	Raw	H	-
	M	21	7	-	Co-op.	H	Non-pul.
	M	18	6	-	Co-op.	H	-
	F	45	5	-	-	H	-
	F	26	7	+	-	H	Pul.
	M	48	5	-	Co-op.	H	-
	M	35	6	-	-	H	Pul.
	M	30	5	-	Raw	H	-
	M	15	6	+	Co-op.	H	Pul.
	M	20	5	-	Raw	B	-
	M	9	9	+	Raw	B	-
	M	17	9	+	Raw	B	-
3 apartments	M	15	9	-	-	H	-
	M	54	8	+	Co-op.	H	Pul.
	M	14	8	+	Raw	H	-
	M	16	6	-	Co-op.	H	Pul.
	F	18	6	+	Raw	H	Pul.
	F	21	10	-	Co-op.	H	-
	M	8	6	+	Co-op.	H	-
4 apartments	M	17	10	+	Co-op.	H	-

	Sex	Age	Inmates	Income	Milk	Type	History
5 apartments	F	5	17	+	Co-op.	H	Pul.

Rural Area

Satisfactory Housing

3 apartments	F	21	4	-	Raw	H	Pul.
	M	8	3	-	-	H	Pul.
	M	20	4	-	Raw	B	Non-pul.

Substandard Housing

1 apartment	M	33	3	+	-	H	Pul.
	M	23	2	-	-	H	-
	M	12	4	+	Raw	B	-
	M	2	6	+	Raw	B	-
2 apartments	M	13	4	-	Raw	H	Pul.
	F	19	5	-	Raw	H	Pul.
	F	17	8	-	Co-op.	H	-
	F	45	4	-	Raw	B	-

The accompanying map gives an indication of the distribution of tuberculous infections in Lanarkshire. The industrial area is coloured red and the rural area green. That part of the City of Glasgow, coloured grey, which lies within the Civil County of Lanark is not included in the survey.

INDUSTRIAL AREA.

RURAL AREA.

COUNTY OF LANARK

SCALE
1:190,080 - 3 Miles to 1 inch
0 1 2 3 4 5 6 7 8 9